

Table 4-1. ECS/AM-1 Data Flows (3 of 4)

From	To	Data Flow	Description	Communications Link
EOC	SSIM	SSIM Commands [3]	AM-1 spacecraft and instrument commands in CCSDS CLTUs. Data Rates: 10 kbps; 1 kbps; 125 bps; 2 kbps.	Will be specified in the ICD Between the EOS AM-1 Spacecraft Simulator and the ECS.
SSIM	EOC	SSIM Telemetry [4] ¹	SSIM Telemetry includes the following: AM-1 simulated real time health & safety/housekeeping data. Data Rates: 1 kbps; 16 kbps. AM-1 simulated recorded housekeeping data. Data Rates: —256 kbps; —512 kbps. AM-1 simulated SCC, CTIU, or instrument memory dump data. Data Rates: 1 kbps; 16 kbps.	Will be specified in the ICD Between the EOS AM-1 Spacecraft Simulator and the ECS.
AM-1 Spacecraft Vendor	EOC	Data Base Delivery [5]	Spacecraft and Instrument data base information	Will be specified in the Data Format Control Document (DFCD) for the EOS AM-1 Project Data Base
AM-1 Spacecraft Vendor	EOC	SAS Delivery [6]	Spacecraft Analysis Software delivery	Not applicable

¹ The SSIM outputs telemetry in CADU format. The EOC receives the telemetry as CCSDS packets and CLCWs. CADU-to-CCSDS packet/CLCW conversion is performed by the ETS.

AM-1 SCS forwards the AM-1 telemetry CADUs to EDOS, where they are forwarded (in EDU format) via Ecom links to the EOC for monitoring [Table 4-1, Data Flow 2].

4.3 Spacecraft Simulator Interfaces

The SSIM will be used by the AM-1 flight operations team for command procedure development and validation (including validating flight software updates and SCC loads), flight operator training, and anomaly investigation support. The SSIM allows the flight operations team to observe the effects of specific EOC-defined command sequences on the AM-1 spacecraft. The EOC/SSIM interface is depicted in Figure 4-1.

The EOC/SSIM interface will support all operational AM-1 command data rates. The EOC provides command sequences to the SSIM to simulate certain spacecraft situations, including failures, to allow investigation of spacecraft behavior during pre-defined situations. The SSIM accepts AM-1 commands in CLTU format [Table 4-1, Data Flow 3], processes the commands, and outputs to the EOC realistic simulated spacecraft telemetry for all spacecraft equipment modules, assemblies, and instruments [Table 4-1, Data Flow 4]. The SSIM also will output updated CLCWs, in response to the commands that it receives. Details of telemetry interface between the SSIM and EOC will be defined in the ICD Between the EOS AM-1 Spacecraft Simulator and the ECS . These details include the communications link between the SSIM and the EOC and the format of the telemetry output from the SSIM (CADUs). The simulated AM-1 and instrument telemetry data will be received by the EOC in the form of CCSDS packets. ~~The SSIM/EOC telemetry interface will support all operational data rates with the exception of the 150 Mbps high-rate spacecraft recorder dump.~~

4.4 Pre-mission Interfaces

This section describes the delivery of data bases and software to support pre-mission tests and subsequent for on-orbit operations. These pre-mission interfaces are shown in Figure 4-1.

4.4.1 Data Base Delivery

Each instrument team will provide an instrument data base information in the form of an Instrument Data Base (IDB) to AM-1 spacecraft vendor. The IDB will contain the instrument command and telemetry parameters required for commanding and monitoring (instrument telemetry formats, limits, calibration curves, command procedures, etc.). The AM-1 spacecraft vendor will be responsible for the preparation of the Spacecraft Data Base (SDB) which defines the corresponding AM-1 spacecraft command and telemetry parameters.

The AM-1 spacecraft vendor will form the Project Data Base (PDB) by merging the AM-1 SDB and the IDBs. This PDB will be used by the AM-1 spacecraft vendor during spacecraft and instrument I&T. The AM-1 spacecraft vendor will deliver the approved PDB file to the EOC for use in pre-launch testing and operations [Table 4-1, Data Flow 5].

5.2.2 Spacecraft Simulator Interface Requirements

- AM1-0150 The EOC shall have the capability to send and the SSIM shall have the capability to receive AM-1 spacecraft and instrument commands in CCSDS CLTU format (as defined in AM-1 ICD-106).
- AM1-0160 The SSIM shall have the capability to send and the EOC shall have the capability to receive simulated real time AM-1 spacecraft and instrument housekeeping telemetry and Command Link Control Words (as defined in AM-1 ICD-106)².
- ~~AM1-0170 The SSIM shall have the capability to send and the EOC shall have the capability to receive simulated recorded AM-1 spacecraft and instrument housekeeping telemetry (as defined in AM-1 ICD-106)⁴.~~
- AM1-0200 The SSIM shall have the capability to send and the EOC shall have the capability to receive simulated AM-1 SCC, CTIU, and instrument microprocessor memory dump telemetry and Command Link Control Words (as defined in AM-1 ICD-106)⁴.

5.2.3 Pre-mission Interface Requirements

- AM1-0215 The AM-1 spacecraft vendor shall have the capability to provide and the EOC shall have the capability to receive, AM-1 project data base information containing both spacecraft and instrument parameters.
- AM1-0220 The ECS shall have the capability to provide and the MISR, MOPITT, MODIS, and CERES PIs/TLs shall have the capability to receive IST toolkit software, IST toolkit software upgrades, and IST toolkit documentation.
- AM1-0225 The AM-1 spacecraft vendor shall have the capability to provide and ECS shall have the capability to receive spacecraft analysis tools for implementation and integration into the EOC.

5.2.4 IST Toolkit Interface Requirements

- AM1-0230 The IST toolkit shall have the capability to accept data from a science computing facility that supports PI/TL operations, which include the following data (at a minimum):

² The SSIM outputs telemetry in CADU format. The EOC receives the telemetry as CCSDS packets and CLCWs. CADU-to-CCSDS packet conversion is performed by the ETS.

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- AM1-1100 The EOC shall be capable of receiving two housekeeping telemetry packet streams of 16 kbps from the SSIM⁵.
- AM1-1110 The EOC shall be capable of receiving a health and safety telemetry packet stream from the SSIM at 1 kbps⁵.
- AM1-1120 The EOC shall be capable of receiving a diagnostic telemetry/memory dump packet stream from the SSIM at 16 kbps⁵.
- ~~AM1-1130 The EOC shall be capable of receiving a spacecraft recorder housekeeping telemetry packet stream from the SSIM at 256 kbps or 512 kbps⁵.~~
- AM1-1150 ECS shall contribute a loop delay of not greater than 2.5 seconds of the total system delay of five (5) seconds for emergency real-time commands, not including the time needed for command execution. The loop delay is measured from the originator to the spacecraft/instrument and back and only applies when a Tracking and Data Relay Satellite System (TDRSS) link is available for contact to the spacecraft.

⁵ The SSIM outputs telemetry in CADU format. The EOC receives the telemetry as CCSDS packets and CLCWs. CADU-to-CCSDS packet/CLCW conversion is performed by the ETS.